Opioids in Pediatric Practice – safe as houses or safety in numbers?

Conor Mc Donnell,
Hospital for Sick Children,
Department of Anesthesia & Pain Medicine.
Objectives

1.0…Present recent work & findings

2.0…Discuss next steps
Dividing the PCA demand requests by the number of actual deliveries could predict which patients will go on to develop severe pain...

...? early predictor of increased opioid requirements... maybe even a predictor of increased side effects?
Next step

Retrospective study...all idiopathic scoliosis patients for previous 3 years as per APS database

...223 patients

...exclude ASA 4-5, all post-op ventilation, absence of or incomplete PCA data, non-morphine PCA...

...60 excluded in total

...163 patients recruited and analyzed
<table>
<thead>
<tr>
<th></th>
<th>&lt; 1.5</th>
<th>≥ 1.5</th>
<th>&lt; 2.0</th>
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<tbody>
<tr>
<td>4-hour PCA ratio</td>
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<td>Morphine consumption</td>
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<td>(mg/kg)</td>
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<tr>
<td>$n = 65$</td>
<td>1.1</td>
<td>1.4 *</td>
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<td>1.4 †</td>
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<td>[0.9-1.5]</td>
<td>[1.2-1.8]</td>
<td>[1.0-1.6]</td>
<td>[1.2-1.9]</td>
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<td>NRS</td>
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<td></td>
<td>3.5</td>
<td>4.5 ‡</td>
<td>3.8</td>
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<td>(2.3)</td>
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<td>8-hour PCA ratio</td>
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</table>

Data presented as median [interquartile range] and mean (SD) and $n$ (%); *$P = 0.0002$; †$P = 0.0001$; ‡$P = 0.02$. 
Table 3. Comparison of opioid-related side effects and Acute Pain Service interventions for PCA ratios < 1.5 and ≥ 1.5, and < 2.0 and ≥ 2.0 calculated at 8-hours after scoliosis repair.

<table>
<thead>
<tr>
<th>PCA ratio derived at 8 hours</th>
<th>&lt; 1.5</th>
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<tr>
<td>n = 64</td>
<td></td>
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<tr>
<td>Nausea and vomiting</td>
<td>26 (40.6)</td>
<td>29 (31.3)</td>
<td>43 (41.7)</td>
<td>12 (27.3)</td>
</tr>
<tr>
<td>Pruritus</td>
<td>13 (20.3)</td>
<td>30 (36.1)*</td>
<td>29 (28.2)</td>
<td>14 (31.8)</td>
</tr>
<tr>
<td>Sedation score ≥ 2</td>
<td>8 (12.5)</td>
<td>23 (27.7)*</td>
<td>20 (19.4)</td>
<td>11 (25.0)</td>
</tr>
<tr>
<td>Oxygen desaturation</td>
<td>12 (18.7)</td>
<td>17 (20.5)</td>
<td>20 (19.4)</td>
<td>9 (20.5)</td>
</tr>
<tr>
<td>Unscheduled PCA interventions from APS</td>
<td>19 (29.7)</td>
<td>40 (48.2)*</td>
<td>39 (37.9)</td>
<td>20 (45.5)</td>
</tr>
</tbody>
</table>

Data presented as n (%) (percentage); * P = 0.04.
...a 4 hour PCA ratio of 1.5 (in a rigidly defined surgical population where data was collected retrospectively) predicted increased pain and opioid consumption at 24 hours post idiopathic scoliosis repair...in a way that standard VAS pain scores could not and indeed, do not...
...an 8 hour PCA ratio of 1.5 also identified those patients who will proceed to develop opioid related side effects such as sedation and pruritus... at this point you will also require more PCA interventions from the Acute Pain Service
...leading to

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<td>Time to discharge from HSC (hours)</td>
<td>145 (39)</td>
<td>164 (59)</td>
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2.0...Why are we here?

We aim to demonstrate that severe post-operative pain may be predicted early in the surgical patient’s post-operative course by using the PCA ratio as an identifier, and that the progression of severe postoperative pain and development of opioid-induced side effects can be modified by using the PCA ratio as a trigger for early intervention.
The primary hypothesis is that early opioid rotation at four hours post scoliosis surgery, guided by the PCA ratio of patient demands to PCA pump deliveries (< 1.5 vs ≥ 1.5), will result in lower pain scores at 24 hours post surgery.
Secondary questions to be addressed comprise:

- [Question 2] whether patients with increased PCA ratios ($\geq 1.5$) four hours post scoliosis repair demonstrate increased opioid consumption at 24 hours post surgery.

- [Question 3] whether patients randomized to early opioid rotation to PCA hydromorphone (4 hour PCA ratio $\geq 1.5$) will experience fewer opioid related side effects than those randomized to continue to receive PCA morphine (4 hour PCA ratio $< 1.5$).
2.0 Protocol

Standardized anesthesia for ASA I-II adolescent scoliosis repair
Post-op ventilation, peri-op epidural or spinal morphine all to be excluded

Start PCA morphine in PACU
At 4 hours...calculate PCA ratio (demands/deliveries)
PCA < 1.5

- Recruit to non-intervention group
- Continue PCA morphine as Group A (NG)
PCA > 1.5

- Recruit in blinded, randomized fashion to either…

Continue with morphine PCA
  Group B (MG)

Or, Change to hydromorphone PCA
  Group C (HG)
Data to be collected

Usual demographics
Peri-op morphine, propofol, remifentanil consumption
NRS pain scores
PCA ratios
Morphine, hydromorphone consumption
Sedation, pruritus, N&V scores
Number of APS visits & duration of hospital stay
Outcome Measures
Primary Hypothesis

 Patients in the Study Group [HG] will have lower pain scores at 24 hours after surgery compared to patients in the Control group [MG]

24-hr NRS for HG vs MG
Outcome Measures
Secondary Question

Those patients with PCA ratio $\geq 1.5$ at 4 hours post-scoliosis repair will have significantly increased opioid consumption at 24 hours after surgery compared to patients with 4 hour PCA ratio of $<1.5$…

ie 24-hr morphine consumption in group $[MG] > [HG]$
Outcome Measures
Other secondary Question

Patients randomized to Group [HG] will have fewer side effects in the first 48 hours after surgery than those patients randomized to the Group [MG]…

…N&V, Sedation, Pruritus, Oxygen desaturation, adjunctive medications for same
• Sample size estimation for the primary outcome is based on our retrospective data that demonstrated mean 24-hour NRS scores of 4.5 (± 2.2) in patients with PCA ratio > 1.5 four hours post idiopathic scoliosis repair. To demonstrate reduction in pain scores to mean 24-hour NRS of 3.5 – which would establish a clinically important difference – we estimate that 76 patients per group will be required for a two-tailed $\alpha$ of 0.05 and a $\beta$ of 0.2 (power = 80%).

• Therefore, 80 patients will be recruited to the Control group and 80 patients will be recruited to the Study group in order to accommodate any potential protocol violations or incomplete data sets.

• We will also recruit 80 patients to the Non-Intervention Group, therefore a total numbers of 240 patients will need to be recruited.
Significance

• Other populations (surgical & medical)?

• Adult & Peds?

• Finer tuning of PCAs and how they are delivered?

• A new outcome measure for research?
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